NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

April 23, 2015

AIRWORTHINESS GROUP CHAIRMAN'S FACTUAL REPORT

NTSB No: WPR14FA137

A. ACCIDENT

Operator:	Helicopters, Incorporated
Aircraft:	Airbus Helicopters AS350 B2, Registration N250FB
Location:	Seattle, Washington
Date:	March 18, 2014
Time:	0740 Pacific daylight time

B. AIRWORTHINESS GROUP

Group Chairman:	Chihoon Shin National Transportation Safety Board Washington, District of Columbia
Member:	Ronald Price National Transportation Safety Board Washington, District of Columbia
Member:	Roy Hardie FAA Flight Standards District Office Seattle, Washington
Member:	Bill DeReamer Helicopters, Incorporated Cahokia, Illinois
Member:	Thierry Loo Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile Le Bourget, France
Member:	Gilles Romeuf Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile Le Bourget, France

Member:	Seth Buttner Airbus Helicopters, Incorporated Grand Prairie, Texas
Member:	Michel Martin Airbus Helicopters Marignane, France
Member:	Bryan Larimore Turbomeca USA Grand Prairie, Texas

LIST OF ACRONYMS

AD	airworthiness directive
ATT	aircraft total time
BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile
CT	computed tomography
ENG	electronic news gathering
FAA	Federal Aviation Administration
lbs	pounds
NTSB	National Transportation Safety Board
PDT	Pacific daylight time
RNT	Renton Municipal Airport
S/N	serial number
SB	service bulletin
TSN	time since new
TSO	time since overhaul
UTAS	UTC Aerospace Systems
UTC	United Technologies Corporation
WA	Washington
WN16	KOMO TV Heliport

C. SUMMARY

On March 18, 2014, at about 0740 Pacific daylight time (PDT), an Airbus Helicopters AS350 B2 helicopter, registration N250FB, was destroyed when it impacted terrain following takeoff from the KOMO TV Heliport (WN16) in Seattle, Washington (WA). The helicopter was registered to, and operated by, Helicopters Incorporated under the provisions of Title 14 *Code of Federal Regulations* Part 91. The commercial pilot and one passenger were fatally injured. One person occupying a stationary automobile was seriously injured when the accident helicopter impacted terrain adjacent to the automobile. Visual meteorological conditions prevailed and no flight plan was filed for the local repositioning flight that was originating at the time of the accident. The pilot's intended destination was the Renton Municipal Airport (RNT) in Renton, WA.

Examination of the accident site revealed that the helicopter came to rest on its right side, oriented on a magnetic heading of about 050 degrees. A vehicle located east of the main wreckage was fire damaged. Another vehicle, located immediately west of the main wreckage was oriented on a southerly heading and exhibited downward crushing of the roof and hatchback structure due to impact by the helicopter. All major structural components of the helicopter were located in the immediate area of the main wreckage. Wreckage debris was located within an approximate 340 foot radius to the main wreckage.

On June 23-24, 2014, members of the Airworthiness Group convened at United Technologies Corporation (UTC) Aerospace Systems (UTAS) facilities in Vernon, France for a disassembly examination of the main and tail rotor servo controls. The examination found no evidence of gouges on the servo sliding valves, but revealed reddish-tan colored globular residue on the left roll and right roll servo control locking pin springs and filters. The globular residue was later analyzed by the NTSB Materials Laboratory which found traces of aluminum and magnesium hydroxides. On June 25-26, 2014, the Airworthiness Group convened at Airbus Helicopters facilities in Marignane, France for a disassembly examination of the main and tail rotor servo control accumulators and solenoid switches, the hydraulic pump, and the yaw load compensator. The examination found no evidence of excessive wear on the hydraulic pump gear teeth and splines, but did exhibit evidence of heat distress from the post-crash fire.

D. DETAILS OF THE INVESTIGATION

1.0 HELICOPTER INFORMATION

1.1 HELICOPTER DESCRIPTION

The Airbus Helicopters AS350 B2 has a three-bladed main rotor system that provides helicopter lift and thrust.[1] A two-bladed tail rotor system provides anti-torque and directional control. The helicopter flight controls are hydraulically assisted by a single hydraulic system consisting of three servo controls for main rotor control and one servo control and yaw load compensator for tail rotor control. The helicopter is equipped with a high skid-type landing gear. The helicopter is equipped with a Turbomeca Arriel 1D1 turboshaft engine. The helicopter is type certificated under Federal Aviation Administration (FAA) Type Certificate No. H9EU.

[1] The main rotor blades rotate in a clockwise direction when looking down at the main rotor disc from top-looking-down.

1.2 HELICOPTER HISTORY

The accident helicopter, serial number (S/N) 3669, was manufactured in January 2003 and had accumulated an aircraft total time (ATT) of about 7,706.5 flight hours at the time of the accident. According to helicopter records, engine S/N 9849 was installed on the helicopter at the time of the accident and had accumulated about 7,122.9 hours time since new (TSN) and 538 hours time since overhaul (TSO), respectively.

2.0 WRECKAGE DOCUMENTATION AT THE ACCIDENT SITE AND AFTER RECOVERY

The helicopter came to rest on its right side oriented on a magnetic heading of about 50º. The majority of the main cabin and forward section of the tailboom were either exposed to or consumed by the post-crash fire (**Photo 1**). The remainder of the tailboom was found adjacent to the main wreckage and did not exhibit heat damage from the post-crash fire. The right horizontal stabilizer exhibited crushing deformation consistent with ground impact forces. The left horizontal stabilizer did not exhibit evidence of damage. The areas forward and aft of the horizontal stabilizer exhibited signatures of deformation. The vertical fin remained attached to the tailboom and exhibited signatures of slight deformation damage. Several fragmented pieces of the cockpit instruments were found in the wreckage but were either severely heat distressed or consumed by the post-crash fire.

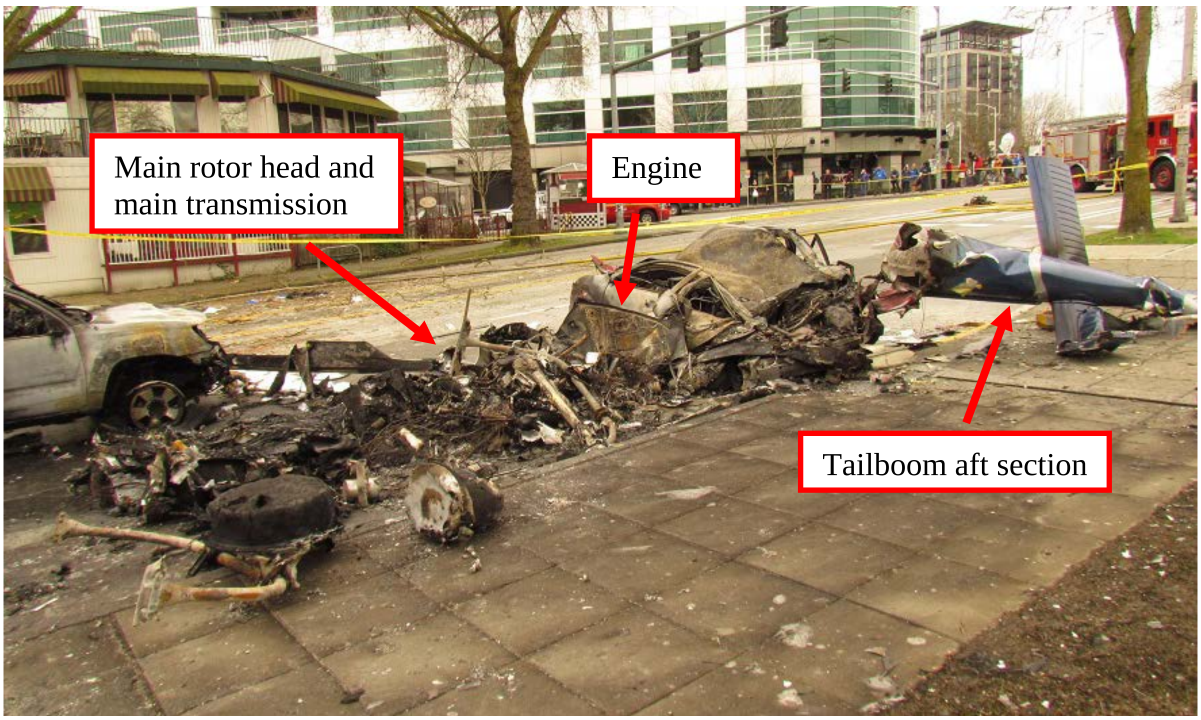

Photo 1. The accident site.

2.1 MAIN ROTOR SYSTEM

All three main rotor blades were observed attached to the main rotor head at the main wreckage site. Fractured tree branches were found collocated with one of the main rotor blades. The main rotor blades exhibited fragmentation. Additionally, the main rotor blade sleeves and the Starflex arms exhibited fracturing consistent with high rotational energy impact damage and thermal damage from exposure to the post-crash fire.

The main transmission was observed in the main wreckage site laying on its right side. The four main transmission suspension bars were fractured and exhibited thermal damage. The anti-torque bi-directional crossbeam was found in its installed position but exhibited heavy sooting and heat distress. The engine-to-transmission drive shaft was fractured adjacent to the transmission-side flange, but the flange remained attached to the transmission input pinion via flexible coupling and exhibited heat distress. The remaining portion of the engine-to-transmission drive shaft was found within the wreckage and exhibited heat distress. The main rotor shaft remained attached to the Starflex. The pitch change rods remained attached between the rotating swashplate and each pitch change horn. The rotating and stationary scissors remained attached but exhibited evidence of heat distress.

2.2 FLIGHT CONTROL SYSTEM

At the time of the accident, only the right-side set of pilot flight controls were installed in the helicopter.[2] The cyclic stick, collective stick, and yaw pedals were found loose within the wreckage and exhibited thermal damage from exposure to the post-crash fire. The fuel control quadrant was also recovered and exhibited thermal damage from exposure to the post-crash fire. The tail gearbox control input rod was continuous through the tailboom aft section, but was fractured on both the aft and forward ends. The forward end exhibited thermal damage and the aft end exhibited signatures consistent with overload. The collective locking plate[3] was recovered loose within the wreckage and exhibited thermal damage from exposure to the post-crash fire (**Photo 2**). The circular cut-out in the locking plate, used to secure the locking stud on the collective, did not exhibit gross deformation or damage. The locking stud mounted to the forward end of the collective stick had separated from the end of the collective stick. The locking stud pin remained in the end of the collective stick but had fractured in shear (**Photo 3**). The locking stud was not recovered in the wreckage.

Photo 2. The recovered collective locking plate.

[2] As part of the electronic news gathering (ENG) modification, the left-side flight controls were removed.

[3] The collective locking plate is mounted to the central console in the cockpit. The pilot can lower the collective stick and insert the locking stud, on the forward end of the collective stick, into the circular cut-out in the locking plate to lock the collective stick. This action is intended to prevent inadvertent collective stick manipulation during preflight checks and to prevent the collective stick from "jumping up" when the main rotor servo control accumulators are depleted during the startup hydraulic system checks.

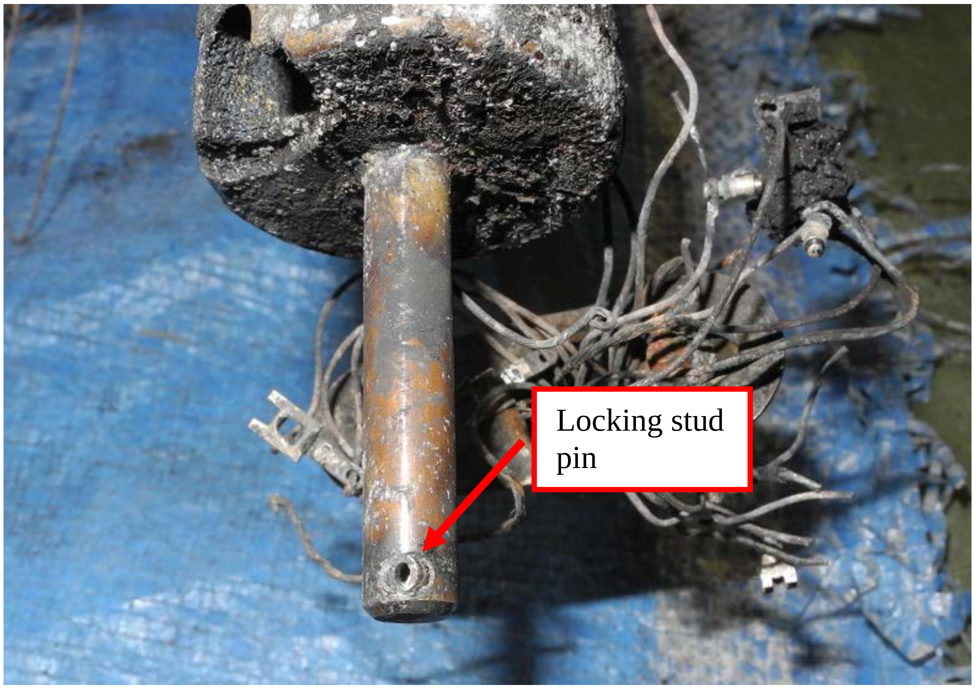

Photo 3. The sheared locking stud pin on the collective lever.

The tail rotor servo control was found immediately aft of the engine (**Photo 4**). The aft end of the tail rotor servo control was melted and the servo as a whole exhibited thermal damage. All attaching hardware on the tail rotor servo piston rod end and the servo input lever were present. The control linkage to the servo input lever was consumed by the post-crash fire. The yaw load compensator was found aft of the tail rotor servo and exhibited heavy thermal damage.

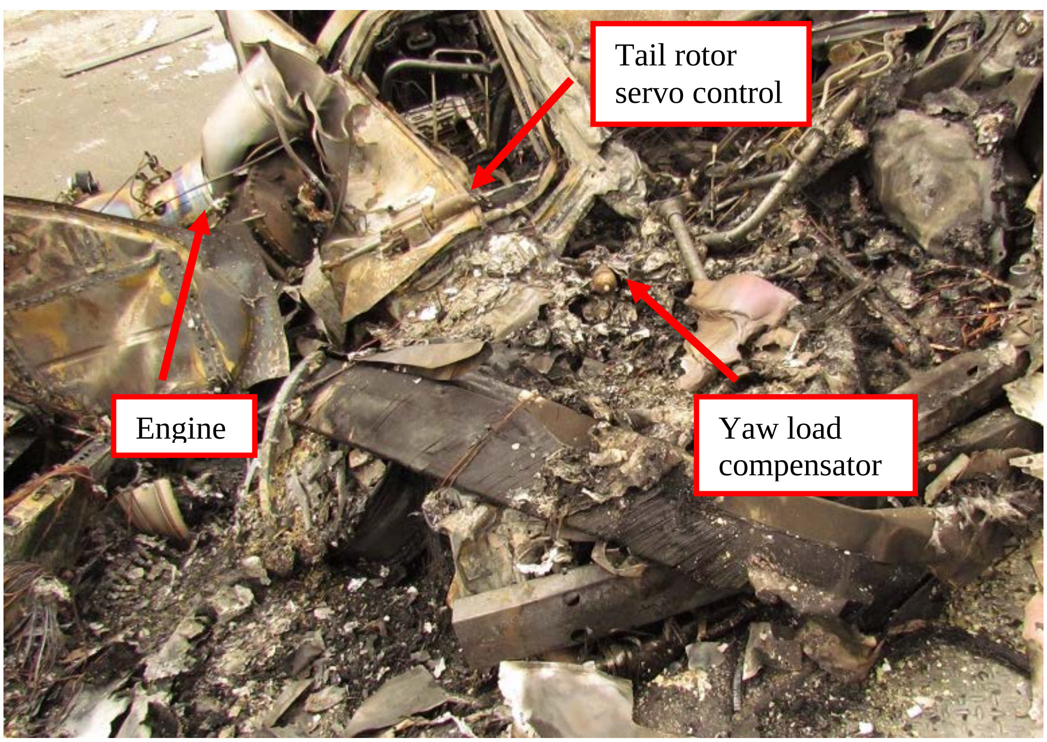

Photo 4. Tail rotor servo control and yaw load compensator as found at the accident scene.

The left roll, right roll, and fore-aft [main rotor] servo controls were found attached to the stationary swashplate and the main transmission housing (**Photo 5**). Both left roll and right roll servo controls exhibited heavy sooting and exhibited signatures of heat distress. The upper housing of the fore-aft servo control was partially fractured and the servo control exhibited signatures of heat distress. The accumulators remained attached to all three main rotor servo controls. The control linkages were mostly consumed by the post-crash fire, but the attaching hardware connecting the control linkages to the main rotor servo control input levers were found in their installed positions. All hydraulic lines connecting to the servo controls were consumed by the post-crash fire. The hydraulic pump and hydraulic distribution block were recovered and exhibited thermal damage. The hydraulic pump belt and the hydraulic reservoir were consumed by the post-crash fire.

The right roll servo control, left roll servo control, fore-aft servo control, tail rotor servo control, yaw load compensator, hydraulic pump, and hydraulic distribution block were retained for further examination.

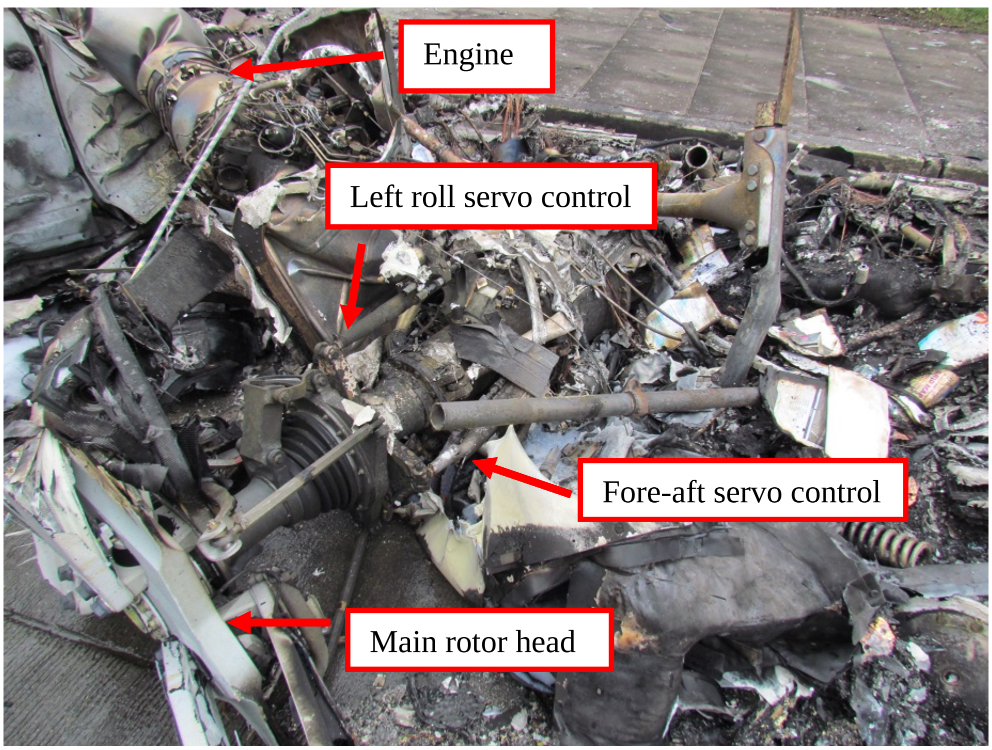

Photo 5. Main rotor servo controls as found at the accident scene (right-roll servo control hidden in this photo).

2.3 TAIL ROTOR SYSTEM

The tail rotor blade pitch control links remained attached between the pitch change horn and the pitch change spider. The two tail rotor blades remained attached to the tail rotor yoke. The first tail rotor blade exhibited splintering and fragmentation, consistent with high rotational energy impact damage, on its outboard half of the blade. The leading edge of the first tail rotor blade exhibited scuff marks, wrinkling at the leading edge, and a flattened appearance with traces of yellow paint overlaid on the tip of the leading edge. Yellow paint of similar color was also observed on the blade skin adjacent to the leading edge (**Photo 6**). Similar yellow colored paint was observed to be on the street curb where the helicopter came to rest (**Photo 7**). The second tail rotor blade exhibited cracks on the blade skin adjacent to the leading edge, deformation of its leading edge on the outboard half of the blade, and chordwise scratches on the blade skin (**Photo 8**). The leading edge of the second tail rotor blade exhibited impact marks consistent with high rotational energy, with the severity of the scuff marks increasing going outboard of the blade.

The tail rotor gearbox remained attached to the tailboom. Continuity of drive through the tail rotor gearbox was confirmed when manually rotating the input flange. The tail rotor shaft key (also known as the woodruff key) was found intact. The rear [aluminum] tail rotor drive shaft, attached to the tail rotor gearbox input flange via flexible coupling, was fractured at the aft end of the drive shaft flange; the fracture surfaces exhibited signatures consistent with overload. The forward end of the tail rotor drive shaft was fractured and exhibited signatures of thermal damage from exposure to the post-crash fire. The tail rotor drive shaft was continuous between both fractured ends but exhibited deformation damage. The forward splined end of the tail rotor drive shaft was recovered in the wreckage and exhibited heat distress, but the splines did not exhibit evidence of abnormal wear. The splined coupling which connects to the forward splined end was recovered. The splined coupling remained connected to the flexible coupling, which contained fractured flange tangs (from the aft flange of the forward [steel] tail rotor drive shaft) on its opposing side; the flexible coupling was bent but not splayed. The forward tail rotor drive shaft was recovered from the wreckage and exhibited heat distress. The tangs of its forward flange were bent and remained attached to splayed pieces of flexible coupling. The engine tail rotor output flange remained bolted to remnants of the splayed flexible coupling and its tangs exhibited deformation in an aft direction.

Photo 6. The leading edge tip end damage on the first tail rotor blade.

Photo 7. The yellow curb adjacent to the resting position of the tailboom.

Photo 8. The leading edge damage on the second tail rotor blade.

2.4 ENGINE

The engine and the engine deck were found at the main wreckage site laying on its right side. The external surfaces of the engine exhibited heat distress. All fuel, oil, and air pipes were found installed and safety wired. The engine throttle pointer, located on the engine, was sooted and heat distressed but was readable; the pointer was found indicating about 40º.[4] The gas generator could be manually rotated. The leading edges of the axial compressor blades exhibited

[4] According to the engine manufacturer, at flight idle, the throttle points to about 52º. At ground idle the throttle points to about 25º.

evidence of hard body impact damage.[5] The leading edge outboard tip of one axial compressor blade exhibited curling deformation in the direction opposite of normal rotation consistent with soft body impact damage.[6] The free turbine could not be manually rotated and exhibited no evidence of blade shedding. The reduction gearbox was removed and inspection of the input pinion slippage mark[7] was offset in the tightening direction by about 0.07 inches, consistent with engine power at the time of main rotor impact. After removal of the reduction gearbox, the free turbine could be manually rotated but the power shaft could not be manually rotated. The engine front support was removed revealing the freewheel shaft and power shaft mating flanges. After removal of the front support, the freewheel could be manually rotated and proper freewheel operation was confirmed. The engine was retained for further examination.

3.0 ENGINE DISASSEMBLY EXAMINATION

On May 21, 2014, members of the Airworthiness Group convened at Turbomeca facilities in Grand Prairie, Texas for a disassembly examination of the engine. The centrifugal compressor blades exhibited sooting on the inlet side of the blades. Debris was found accumulated in the combustion can and was crushable with light finger pressure, consistent with soot deposits. All compressor and power turbine blades were present with no evidence of cracks, fractures, or melting. Small quantities of splattered aluminum were found on the first and second stage compressor turbine blades and the power turbine blades.[8] The majority of turbine blades had sooting on their leading edge surfaces.

For additional details on the engine disassembly examination, see the Turbomeca Investigation Report RA/2014/063 in the docket for this investigation.

4.0 COMPUTED TOMOGRAPHY (CT) EXAMINATION

The retained hydraulic system components were examined using CT scans. The scans revealed the piston liner for the left roll servo control was deformed inward immediately below the piston head and the yaw load compensator accumulator exhibited signatures of pitting on its internal wall. Furthermore, the scans revealed the hydraulic pump bearing and pump gears did not exhibit evidence of smearing. The pump’s splined shaft was engaged with no evidence of spline tooth shearing.

For additional information on the findings from the CT scans, see the Computed Tomography and Aircraft Systems Specialist’s Factual Report in the docket for this investigation.

5.0 HYDRAULIC SYSTEM COMPONENT EXAMINATION

The retained hydraulic system components were shipped to the Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA) for disassembly and further examination. On June 23-24, 2014, members of the Airworthiness Group convened at UTAS facilities, formerly Goodrich Actuation

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[5] Hard body impact damage is characterized by a serrated appearance and deep cuts or tears to the blade leading and trailing edges. Hard body impact damage can result from impact with metal parts, concrete, asphalt, and rocks.

[6] Soft body impact damage is characterized by a large radius of curvature or curling deformation to the blade and can cause curling deformation of the blades in the direction opposite of normal rotation. Soft body impact damage can result from impacts with pliable objects such as birds, ice, tire rubber, and plastic objects.

[7] Within the reduction gearbox is a lock nut that secures the input gear to the drive shaft. The nut is indexed by a final torque (location) mark, also references as a slippage mark. The amount of slippage (or amount of overtorque) can be referenced by the quantity and direction the index mark is offset from its original index position.

[8] The engine air intake plenum mounting flange, attached to the forward end of the engine, is composed of aluminum and was consumed by the post-crash fire.

Systems, in Vernon, France, for disassembly and examination of the hydraulic distribution block and the left roll, right roll, fore-aft, and tail rotor servo controls. On June 25-26, 2014, members of the Airworthiness Group convened at Airbus Helicopters facilities in Marignane, France, for disassembly and examination of the yaw load compensator, hydraulic pump, and the accumulator assemblies from the servo controls.

5.1 LEFT ROLL SERVO CONTROL (S/N 913)

The piston rod of the left roll servo control visually did not exhibit bending deformation. The rod end threads exhibited no evidence of thread wear, but did exhibit small nicks consistent with impact damage. The piston rod was removed from the servo control and the piston liner was removed and confirmed to have deformation damage (**Photo 9**). A tan-colored liquid remnant was observed within the piston housing; the piston housing contained a brown-colored residue on its interior surface. A green-colored residue was observed on the central area of the piston surface. The control input locking pin was visually confirmed to be in the locked position. The locking pin contained small, reddish-tan colored globules, the source of which was unidentifiable at the time of the component examination (**Photo 10**). The servo control filter screen contained a wet, black colored residue on its surface. The sliding valve was removed and exhibited no evidence of gouges, but the surfaces exposed to the hydraulic ports exhibited a residue similar to that found on the filter. The sliding valve sleeve had a clean appearance with no evidence of damage.

Photo 9. Deformation of the piston liner of the left roll servo control (red arrow).

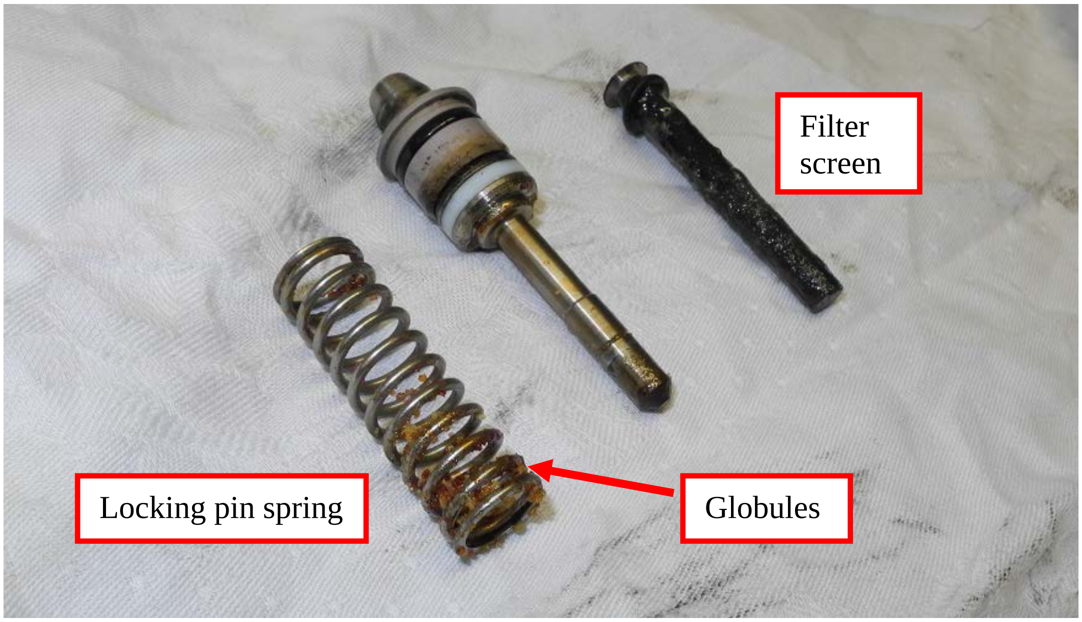

Photo 10. Residue found on the locking pin spring and filter screen.

The solenoid piston assembly did not exhibit evidence of heat distress, but was sooted on its outer surfaces. Its outer and inner springs were present. The outer spring was measured to be about 0.73 inches in length.[9] An oily, tan-colored residue was observed within the solenoid piston housing. No evidence of blockages was found in the solenoid piston hydraulic port.

The valve for the bladder accumulator did not move when pressed. The accumulator was sectioned and the inside contained charred bladder remnants and soot against the accumulator walls. The inner walls of the yaw load compensator accumulator exhibited evidence of surface oxidation.

5.2 RIGHT ROLL SERVO CONTROL (S/N 1381)

The piston rod of the right roll servo control visually did not exhibit bending deformation. The piston upper housing rotated about 0.08 inches when manually rotated. Examination of the contact surfaces between the conical lower attachment (the tri-lobe piece) and the piston upper housing exhibited no evidence of fretting or galling. On the piston head, the plastic scraper seal exhibited evidence of melting due to heat exposure. The piston liner remained intact. The filter screen contained a black, soot-like residue but was otherwise clean. The control input locking pin was visually confirmed to be in the locked position. The locking pin contained small, reddish-tan colored globules. The sliding valve was removed and exhibited no evidence of gouges, but the surfaces exposed to the hydraulic ports exhibited a soot-like residue. The sliding valve sleeve was removed and exhibited damage to the outer diameter of the sleeve, but there was no evidence of damage on the sliding valve contact surfaces.

The solenoid assembly exhibited evidence of heat exposure. Residue was observed on the return port of the solenoid valve. The solenoid piston assembly exhibited discoloration of its lower end consistent with heat exposure. Both its outer and inner springs were present. The outer

[9] According to the helicopter manufacturer, the typical uncompressed length of an outer spring for the solenoid piston assembly is about 0.71 inches.

spring was measured to be about 0.59 inches in length. No evidence of blockages was found in the solenoid piston hydraulic port.

The valve for the accumulator bladder did not move when pressed. The accumulator was sectioned and the inside contained charred bladder remnants and soot against the accumulator walls.

5.3 FORE-AFT SERVO CONTROL (S/N 172)

The piston rod was bent about 4.05 inches from the lower end of the rod. The piston rod surfaces within the servo had a clean appearance. The piston liner had a slight bulge about 2.56 inches from its lower end. The control input locking pin was visually confirmed to be in the locked position. No debris was observed on the locking pin and spring. The filter screen contained a black, soot-like residue but was otherwise clean. The sliding valve was removed and its surfaces exposed to the hydraulic ports exhibited a soot-like residue, but exhibited no evidence of gouges. The inner diameter of the sliding valve sleeve exhibited no evidence of damage.

The solenoid assembly exhibited evidence of heat exposure. The solenoid piston housing exhibited a tan-color stained appearance. Both its outer and inner springs were present. The outer spring was measured to be about 0.67 inches in length. No evidence of blockages was found in the solenoid piston hydraulic port.

The valve for the accumulator bladder did not move when pressed. The accumulator was sectioned and the inside contained charred bladder remnants and soot against the accumulator walls.

5.4 TAIL ROTOR SERVO CONTROL (S/N 1298)

The piston rod and piston liner exhibited evidence of heat distress. A dark-colored band was observed on the piston liner about 3.70 inches from the aft end of the piston liner; the dark-colored band was relatively the same width as the piston head (**Photo 11**). The locking pin was visually confirmed to be in the locked position. The locking pin, spring, and filter screen exhibited evidence of heat distress (**Photo 12**). The sliding valve exhibited no evidence of gouges, but exhibited sooting and oxidation products on the surfaces exposed to the hydraulic ports (**Photo 13**). The sliding valve sleeve was damaged during removal from the servo control.

Photo 11. The dark-colored band observed on the piston liner (red arrow).

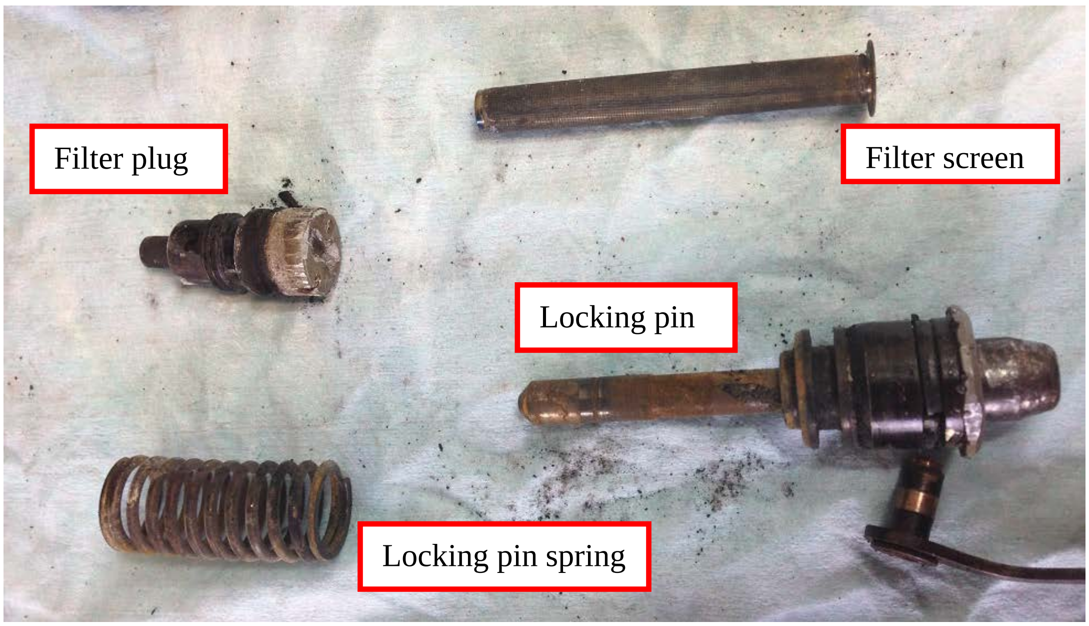

Photo 12. Locking pin, locking pin spring, filter screen, and filter plug for the tail rotor servo control.

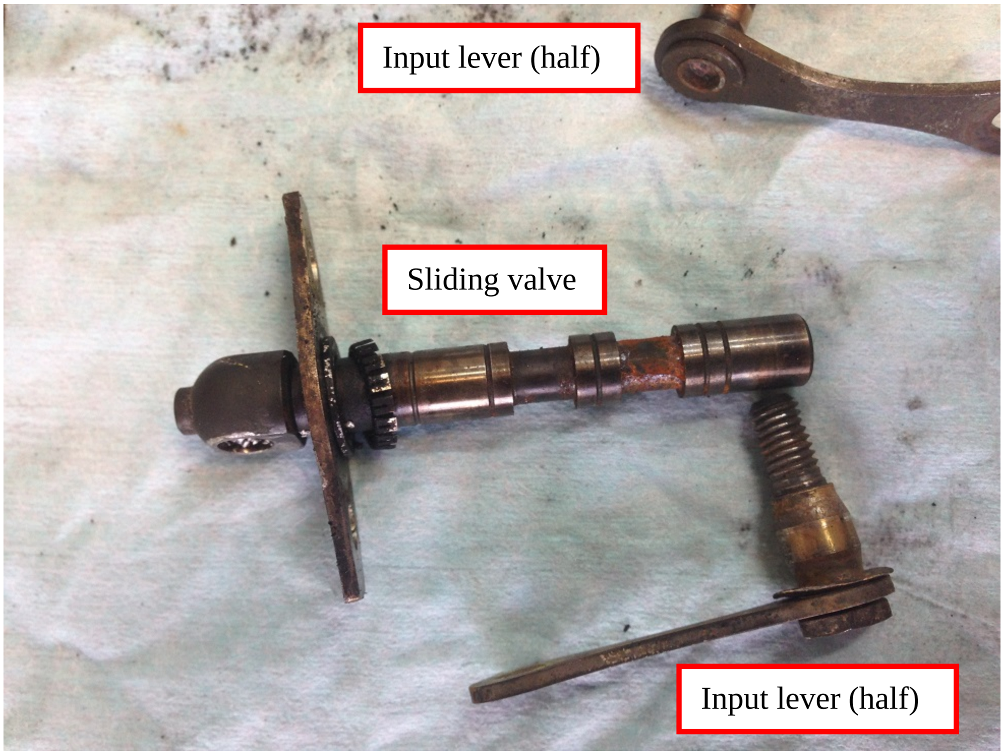

Photo 13. The sliding valve and input lever halves from the tail rotor servo control.

5.5 YAW LOAD COMPENSATOR

The yaw load compensator exhibited signatures of heat distress. The inner surfaces of the output piston and piston bore, both of which contacts hydraulic fluid, exhibited surface oxidation (**Photos 14 and 15**). The output piston scraper seals were present but only partially continuous on their circumference. The solenoid was disassembled and its electrical connections appeared secured. The solenoid piston exhibited no evidence of cracks, but did exhibit signatures of heat distress primarily on its lower surface contacting the hydraulic port (**Photo 16**). The solenoid piston's outer and inner springs were present, with the outer spring exhibiting heat distress. The outer spring was measured to be about 0.55 inches in length. No evidence of blockages was found in the solenoid piston hydraulic port.

Photo 14. Output piston exhibiting surface oxidation.

Photo 15. Output piston bore exhibiting surface oxidation.

Photo 16. Disassembled solenoid from the yaw load compensator.

The valve for the accumulator did not move when pressed. The accumulator was sectioned and the inside contained charred bladder remnants and soot against the accumulator walls. The inner walls of the yaw load compensator accumulator exhibited evidence of surface oxidation.

5.6 HYDRAULIC DISTRIBUTION BLOCK

The clogging indicator in the hydraulic distribution block was observed popped out, with the button exhibiting heat distress.[10] The pressure regulator cap was observed to be hand tight, with the regulator cap and spring exhibiting heat distress. The filter cap was jammed; a hand saw was used to cut off the filter cap to access the filter. The filter was removed and appeared to have a soot-like residue, but was otherwise clean of debris.

5.7 HYDRAULIC PUMP

The hydraulic pump exhibited signatures of heat distress. The hydraulic pump strainer was sooted and metallic particles were observed on the side of the strainer that was exposed to a fractured hydraulic port. The chip detector was sooted and the chip detector remained magnetized. Debris found within the chip detector was not magnetic. The pump gear teeth exhibited no evidence of abnormal wear or fractured gear teeth. The male and female splines for the pulley exhibited signatures of heat distress but did not exhibit evidence of abnormal spline wear or fractured splines. The pulley, shaft, and gears could not be manually rotated.

6.0 NTSB MATERIALS LABORATORY ANALYSIS OF SERVO CONTROL RESIDUE

The reddish-tan color globules found on the locking pin spring of the left roll and right roll servo controls were analyzed by the NTSB Materials Laboratory in Washington DC. A sample of globules taken from the left servo control was sent to an independent, third-party laboratory for analysis, which found the presence of four aluminum hydroxides and magnesium hydroxide, consistent with corrosion

[10] The clogging indicator provides a visual indication, via a button that pops out, for when the hydraulic filter is clogged.

products. For additional details, see the NTSB Materials Laboratory Factual Report No. 15-012 in the docket for this investigation.

7.0 MAINTENANCE

Tail rotor servo control, S/N 1298, was installed on the accident helicopter on March 29, 2012 at ATT 6,548.0 flight hours and a component total time (CTT) of 6,007.0 hours. The tail rotor servo control was overhauled on February 21, 2012 by UTAS in Vernon, France.

On January 22, 2014, at ATT 7,609.7 flight hours, the accident helicopter went through a number of inspection and maintenance actions, which included (but were not limited to):

- a 30-hour, 100-hour, and 150-hour airframe inspection;
- compliance with FAA Airworthiness Directive (AD) No. 2007-12-22, a hydraulic fluid change required for operation in cold weather conditions;
- compliance with AD 2007-06-15, an inspection and lubrication of the hydraulic pump splines;
- compliance with AD 2011-22-05, an inspection for play in the tail rotor pitch change links;
- compliance with Airbus Helicopters Emergency Alert Service Bulletin (EASB) 05.00.58, an inspection of the collective lever lock;
- installation of a new hydraulic pump drive belt (P/N 704A336900008);
- tail rotor gearbox replacement
- dynamic balancing of the tail rotor blade assembly to 0.1 inches-per-second (IPS); and
- main rotor track and balancing;

The inspection and maintenance actions were signed off as completed on January 27, 2014 and the helicopter was released for service after an operational test flight on the same day.

On March 5, 2014 at ATT 7,676.1 flight hours, the operator complied with FAA AD No. 2014-02-05, a recurrent inspection of the clearance between the main rotor collective control lever and the collective locking stud.

On March 13, 2014, at ATT 7,698.5 flight hours, the recurrent 30-hour inspection of the tail rotor blade pitch links, required by AD 2011-22-05, and a 30-hour inspection of the tail rotor blades was performed.

An empty weight/equipment list revisions record, dated March 28, 2012, revealed an empty weight configuration of 3380.90 pounds (lbs). A copy of a filled out weight and balance record, from an unknown date was provided by the operator and revealed an empty weight of 3380.90 lbs. The weight and balance form version was dated February 1, 2014.

Attachment 1 contains the maintenance records for the above maintenance actions and the helicopter weight and balance.

Chihoon Shin
Aerospace Engineer – Helicopters